

M. & R. T. C. 4283. PUTNAM Co.: tidal mudflats, Constitution Island, *M. & C.* 5506. ULSTER Co.: Kingston, *M. & C.* 5504. Westchester Co.: Roa Hook, *M. & C.* 5507.

M. & R. T. C. nos. 4283, 4286, 4287 & 4289 were previously cited (1) under *N. guadalupensis*, as which they should now be deleted. All other New York specimens of *N. guadalupensis* which have been cited by the writer have been reëxamined and remain as originally determined.

Further examination of the available material of *Najas Muenscheri* now makes possible the description of the staminate flowers, which are borne singly in the axils of the upper leaves. These consist of a single anther subtended by two membranous envelopes, the inner of which is 2 mm. long, while the outer is 3 mm. long by .8 mm. wide, with the apex developed into three short lobes. Better material must be secured before it is possible to give the minute details concerning the very small anther.

1. CLAUSEN, R. T. Studies in the genus *Najas* in the northern United States. RHODORA 38: 333-345. 1936.

BAILEY HORTORIUM,
Ithaca, New York.

POLLINATION OF VACCINIUM PENNSYLVANICUM

HARVEY B. LOVELL AND JOHN H. LOVELL

(Plate 456)

THE lowbush blueberry, *Vaccinium pennsylvanicum* Lam., grows wild over large areas of pastureland in Southern Maine. Farmers improve the natural conditions under which it produces fruit by removing other shrubs and trees and occasionally burning over the land. As according to the census of 1930 there are 13,888 acres of wild blueberries in Maine, or four times the area found in the other New England states, Maine offers an excellent opportunity for the study of the ecology of this species of the heath family.

Although the ecology of the highbush blueberry, *V. corymbosum* L., has been studied by Coville, no critical studies have been made on the pollination of the lowbush blueberries. Phipps¹ has reported an extensive investigation on the insect pests of the blueberries and huck-

¹ Phipps, C. R., Me. Agri. Exp. St. Bu. 356, 1930.

leberries in Maine and lists a number of visitors found on the different species of *Vaccinium* but has not studied the ecology of the flowers of *V. pennsylvanicum* in detail.

The lowbush blueberry is seldom more than a foot tall. The flowers, few in number, are in short dense racemes and begin to bloom in Southern Maine by May 20th. The white corolla, often tinged with

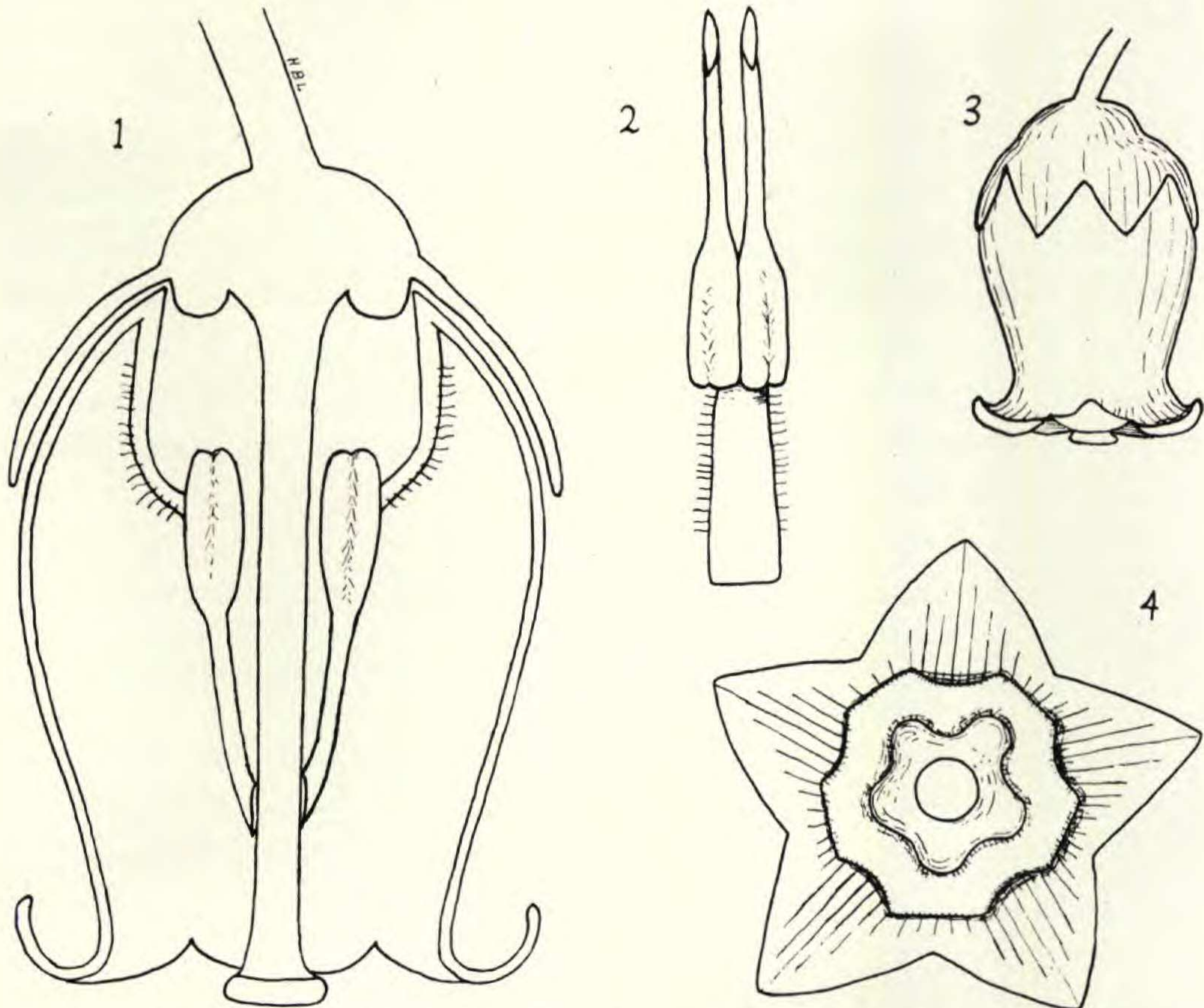


FIG. 1. Details of Flower of *VACCINIUM PENNSYLVANICUM*.

pink, is 6 to 7 mm. long and 4 mm. wide. The flower is bell-shaped, slightly contracted at the mouth with the five lobes reflexed (FIG. 1¹, 2).

The light brown anthers of the ten stamens terminate in slender tubes 1.8 mm. in length (FIG. 1²), the oblique pores of which rest against the style about 2 mm. below the stigma. The white filaments, which are short, broad, and densely hairy on the edges, form so close a ring around the nectary that access to the nectar seems possible only when a bee inserts its tongue between the anther-tubes and the style (FIG. 1¹). This separation of the anther-pores from the style by the

bee allows the white pollen to fall on the head of the visitor. The pollen is in tetrads.

The stigma is capitate and in mature flowers stands nearly in the entrance of the corolla. Around the base of the style there is a five-sided, fleshy, green ring on which nectar is very sparingly secreted (FIG. 1⁴). Although there was an apiary a quarter of a mile away, honey-bees were comparatively rare on the flowers. Three species of bumblebees were observed. A few females of *Andrena vicina* were captured, and two species of female wasps visited the bloom. It is surprising that the number of visitors was so small in comparison with the profusion of flowers, yet they appeared, judging by the set of fruit, sufficient to effect the pollination of most flowers. The bell-shaped corolla excluded short-tongued insects from the nectar, but small species of *Andrena* were often seen hovering over the flowers and occasionally alighting on the anthers. Since pollen was found on the hind legs of one of them, it seems probable that they also assist in the pollination of the flowers.

A list of the visitors is as follows:

APOIDEA: APIS MELLIFERA L. ○; BOMBUS TERNARIUS Say ○; B. TERRICOLA Kirby ○; B. VAGANS Sm. ○; ANDRENA VICINA Sm. ○.
 WASPS: VESPA MACULATA L. ○; a large yellow wasp, not captured.
 DIPTERA: BOMBYLIDAE, BOMBYLIUS SP.

In order to determine how far the production of fruit was dependent upon cross-pollination by insects, the following experiments were made. Three boxes, 18 inches square, were covered with galvanized wire-screening of fine mesh. On May 22d boxes 1 and 2 were placed over a thick growth of blueberry bushes. Box 3, on May 25th, was placed over a dense area of bushes 400 feet from the first location. A few flowers which had already opened were removed. In about a week the plants under the boxes were in full bloom, and the flowers appeared to be in rather better condition than those outside, probably due to the greater warmth.

On July 21st an accurate count was made of the number of berries set under the three boxes. In box 1 seven berries mostly of small size were found; in box 2 there was only one blueberry; while in box 3 there were 23 blueberries. In box 3 the flowers had been more abundant and slightly larger than in the other boxes. In a control area outside of one of the boxes there were three to four hundred berries. The advantage of cross-pollination to the blueberry is clearly shown by these experiments (PLATE 456, FIGS. 1 and 2).

As all insects had been carefully excluded from the flowers in the boxes, the few berries produced appear to be the result of self-fertilization. The flowers of *V. pennsylvanicum* are therefore not entirely self-sterile. Self-pollination may have been brought about by the jarring of the flowers by the wind or rain.

The ecology of variety *nigrum*, which was frequently found among the plants of *pennsylvanicum*, does not differ from that of the latter species. It is visited by the same insects.

WALDOBORO, MAINE.

CONTRIBUTIONS FROM THE GRAY HERBARIUM OF
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ARABIS IN EASTERN AND CENTRAL NORTH AMERICA

MILTON HOPKINS

(Plates 457 and 458)

INTRODUCTION

IN the large family *Cruciferae*, several genera have long needed critical study. *Arabis* is one of these. Its great complexity, not only in North America but likewise in Europe and Asia, has long perplexed assiduous students and, although many excellent treatments have appeared as parts of various regional floras and synopses, no single adequate study of it in North America has, as yet, been made. It was, therefore, with considerable trepidation that I undertook a critical examination of the genus, for I realized too well the vast scope of the problem. The present paper is offered as a first venture and possesses many limitations with which no one is more familiar than I. It treats the genus in eastern North America primarily from the region east of the one hundredth meridian, but in those cases where a species occurs in western North America as well as in the eastern part, I have discussed it throughout the natural extent of its range.

HISTORY

Although Linnaeus tells us¹ that *Arabis* was named for the country Arabia, it has recently come to my attention that perhaps he did not

¹ Phil. Bot. 169 (1751), in which he says of *Arabis*: "Arabia Regione."